**EQUIPMENT PERFORMANCE EVALUATION**
**DENTAL UNIT**
25 TAC §289.232(i)(7)(A)

Service Company_____ Date _____

Survey instrument used _____ Calibration date _____
Type of measuring device: External Probe (ion chamber) _____ Ion Chamber within a housing _____

X-ray unit identification (control panel):

Manufacturer _____ Model No. _____

Serial No. _____ Location _____

**TIMER ACCURACY**

Regulation - 25 TAC §289.232(i)(6)(I)(i): The accuracy of the timer shall meet the manufacturer's specifications. If the manufacturer specifications are not obtainable, the timer accuracy shall be "10 percent of the indicated time with the testing performed at 0.5 second.

Timer accuracy determined by (select which one used):

9 Manufacturer's timer deviation tolerance_____ **OR**

9 "10% tolerance with testing performed at 0.5 second (.500 milliseconds)

Time used for testing _____ □mS □Pulses

Perform four measurements at the above time setting:

_____ milliseconds/pulses
_____ milliseconds/pulses
_____ milliseconds/pulses
_____ milliseconds/pulses

**EXPOSURE REPRODUCIBILITY**

Regulation - 25 TAC §289.232(i)(6)(J): When all technique factors are held constant, the coefficient of variation of exposures for both manual and AEC systems shall not exceed 0.05. See TRC Form 60-3, page 4 for explanation.

$$C = \frac{s}{\overline{X}} = \frac{1}{\overline{X}}\left[\sum_{i=1}^{n}\frac{(X_i - \overline{X})^2}{n-1}\right]^{1/2}$$

Technical Factors Selected: _____ma _____kVp _____time

Output Measurements:

_____ mR
_____ mR
_____ mR
_____ mR

s = estimated standard deviation of the population
X = mean value of observations in sample
$X_i$ = ith observation in sample
n = number of observations in sample.

**EQUIPMENT PERFORMANCE EVALUATION**
**DENTAL UNITS**

**KVP TEST**

Regulations - 25 TAC §289.232(i)(6)(K): The indicated kVp shall be accurate to within "10 percent of the indicated setting at no less than three points over the usual operating range of the machine. For units with fewer than three fixed kVp settings, the units shall be checked at those settings.

Indicated kVp_____ Measured kVp _____ Deviation _____%
Indicated kVp_____ Measured kVp _____ Deviation _____%
Indicated kVp_____ Measured kVp _____ Deviation _____%
Indicated kVp_____ Measured kVp _____ Deviation _____%

((Measured kVp - Indicated kVp) ÷ Indicated kVp) H 100 = % Deviation

Measured kVp within " 10 percent of the indicated setting: Yes ( ) No ( )

**TUBE STABILITY**

Regulations - 25 TAC §289.232(i)(6)(L): The tube shall remain physically stable during exposures. In cases where tubes are designed to move during exposure, the registrant shall assure proper and free movement of the unit.

Tube stable in all orientations: Yes ( ) No ( ) Free movement where designed: Yes ( ) No ( )

**COLLIMATION**

Regulations - 25 TAC §289.232(i)(6)(M)): Field limitation shall meet the requirements of 25 TAC §289.232(i)(11)(B) and 25 TAC §289.232(i)(12).

**Intraoral:**
Minimum source to skin distance (SSD) _____cm.
Field size at tip of cone _____cm.
Field size # to 7 cm.: If the minimum SSD is 18 cm or more Yes ( ) No ( ) N/A ( )
Field size # to 6 cm.: If the minimum SSD is less than 18 cm Yes ( ) No ( ) N/A ( )

**Panoramic:**
X-ray field misalignment at image receptor slit:_____in. X _____in.
(transverse) (vertical)
Misalignment cannot exceed 0.0 inches in the transverse axis: In compliance Yes ( ) No ( )
Misalignment cannot exceed 0.5 inches in the vertical axis: In compliance Yes ( ) No ( )

**Cephalometric:**
Source to image distance (SID) _____ in./cm.
Indicated field size _____in./cm. X _____in./cm.
Measured field size _____in./cm. X _____in./cm.
Misalignment _____in./cm. X _____in./cm.
Does misalignment exceed 2% of the SID: Yes ( ) No ( )

**ENTRANCE EXPOSURE (EE) (See TRC Form 60-3, page 3 for instructions)**

Regulations – 25 TAC §289.232(i)(6)(N) EE limits-
Limit 450 mR for 60kVp and above/600 mR for less than 60 kVp
Technique Factors selected: kVp _____ mA(s) _____ time _____ (for intraoral bite wing only)
Source to Skin Distance (SSD):_____ in/cm Source to Detector Distance (SDD):_____ in/cm
Is tip of cone positioned ½ inch or less from surface of instrument housing or probe? Yes _____
EE _____mR Calculated Measurement □ Direct Measurement □

Signature of surveyor: _____ Date: _____

# DETERMINING THE ENTRANCE EXPOSURE (EE) FOR INTRAORAL DENTAL EXAMINATIONS – 25 TAC §289.232(i)(6)(N)

## A. DETERMINING ENTRANCE EXPOSURE BY CALCULATION:

Note: Ion chambers may be located within the instrument housing rather than within an external probe. In this situation the distance from the top surface of the housing to the ion chamber below must be known. If this type of instrument is used for the EE measurements, the inverse square law must be utilized for accurate results.

**$EE = mR(measured) \times (SDD \div SSD)^2$**

Where: EE = entrance exposure
mR (measured) = indicated exposure on measuring instrument
SDD = source (target) to detector (ion chamber) distance
SSD = source (target) to skin distance

(a) Place the tip of the cone within ½ inch from the housing of the measuring instrument.
(b) Measure the distance form the source to the entrance/tube side surface of the housing.
(c) Determine the distance from the source to the ion chamber within the housing.
(d) Convert all measurements to the same unit. (i.e., Do not use the SDD in inched and the SSD in centimeters.)
(e) Select the kVp, mA, and time normally used for an intraoral bite wing x-ray at that facility. Document the selected technique factors.
(f) Make and exposure and document the measurement in millirem.
(g) Using the above formula, calculate the EE.

## B. DETERMINING ENTRANCE EXPOSURE BY DIRECT MEASUREMENT:

Note: Use this procedure only if and external probe (ion chamber) is available for the measurements.

(a) Position the tube so the end of the cone is not greater the ½ inch from the probe. Do not put the probe inside the cone or allow the cone to have direct contact with the probe.
(b) Select the kVp, mA, and time normally used for an intraoral bite wing x-ray at the facility. Document the selected technique factors.
(c) Measure the distance from the target (source) to the end of the cone. Document this distance.
(d) Make and exposure and document the radiation output in millirem. This direct measurement is the entrance exposure.

# EXPOSURE REPRODUCIBILITY CALCULATIONS

$$C = \frac{s}{\overline{X}} = \frac{1}{\overline{X}}\left[\sum_{i=1}^{n}\frac{(X_i - \overline{X})^2}{n-1}\right]^{1/2}$$

EQUATION

Where:

$C$ = *coefficient of variation*
$s$ = *estimated standard deviation of the population*
$\overline{X}$ = *mean value of observations in sample*
$X_i$ = *ith observation in sample*
$n$ = *number of observations in sample*

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In this example, the exposures are considered to be reproducible.
Example:

The four ($n$) exposures ($X_i$) measured 409 mR, 387 mR, 391 mR, and 410 mR.

STEP 1 Determine the mean value ($\overline{X}$) of the four exposures taken.

*(409 mR + 387 mR + 391 mR + 410 mR) ÷ 4 = 399.25 mR*

STEP 2 Find the difference between each exposure and the mean value (disregard sign).

| | | | |
|---|---|---|---|
| 409.00 mR | 387.00 mR | 391.00 mR | 410.00 mR |
| -399.25 mR | -399.25 mR | -399.25 mR | -399.25 mR |
| 9.75 mR | 12.25 mR | 8.25 mR | 10.75 mR |

STEP 3 Square each of the differences

| | |
|---|---|
| $9.75^2 = 95.06$ | $12.25^2 = 150.06$ |
| $10.75^2 = 115.56$ | $8.23^2 = 68.06$ |

STEP 4 Divide each number by 3 ($n$-1) and add the results

95.06 ) 3 = 31.88
150.06 ) 3 = 50.02

68.06 ) 3 = 22.69
115.56 ) 3 = 38.85
143.11

STEP 5 For s, determine the square root of the above number

$\sqrt{143.11} = 11.96$

STEP 6 Divide s by the mean value (0)

11.9629 ) 399.25 = .0299 = c = the coefficient of variation

STEP 7 If c=0.05 or less, the exposures are considered to be reproducible